Instructor (GMU)  
Dr. Laurence C. Bray  
- E-mail: lbray2@gmu.edu  
- Phone: 703-993-2218  
- Office: Engineering Building, 3911  
- Office hours: By appointment

Co-instructors (INOVA):  
Dr. Mahesh Shenai  
- E-mail: Mahesh.Shenai@inova.org  
Dr. James Leiphart  
- E-mail: James.Leiphart@inova.org

Lectures: Tuesday: 1:30pm-4:10pm, Planet 126

Important Notes and Dates:  
- **Final Exam:** Tuesday, December 19th – 1:30pm-4:15pm  
- **Holidays:** November 22nd – 26th (Thanksgiving)

Course Description:  
This GMU-based class will provide students with the opportunity to learn fundamentals concepts in the classroom and interact with clinical neuro-technologies, through 3-hour practical experiences at the INOVA hospital every three to four weeks. Students will work with faculty and clinicians in both an academic and simulated clinical environment.

Prerequisites: 90 credit hours applicable to the Bioengineering Program, senior standing.

Requirement or Elective:  
- This course is a technical elective for bioengineering students with a 3.00 cumulative GPA minimum.

Course Objectives:  
- Students will be able to solve larger comprehensive engineering problems and evaluate alternative approaches  
- Students will be able to relate engineering concepts to advanced neuro-technologies  
- Students will gain familiarity with engineering practice in working with medical equipment.

Course Topics:  
Assignments and Examinations:

Pre and Post laboratory assignments:
- There will be four pre-laboratory and four post-laboratory assignments.

Laboratories:
- There will be four practical laboratories hosted at INOVA hospital. Additional information will be given in class.

Examinations:
- There will be one midterm and one final exam in a form of practical exercises.

Policies:
Students will NOT be allowed to make up assignments or examinations.

All formal assignments are to be treated as individual and not collective efforts, unless specified otherwise. A severe penalty will be given to any assignment which indicates collusion or cheating. The usual penalty for cheating is failure in the course.

Every assignment must be completed, working, and turned in. For each assignment that is not, the final grade in the course will be lowered.

All assignments will be submitted in class on the day in which they are due. Any assignments turned in after the submission deadline will receive a zero.

Grading Structure:

- The final grade will be based on (Tentative, subject to change):

<table>
<thead>
<tr>
<th>BENG 499</th>
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<tbody>
<tr>
<td>Pre-lab assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Post-lab assignments</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exercise</td>
<td>30%</td>
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<tr>
<td>Final Exercise</td>
<td>30%</td>
</tr>
</tbody>
</table>

- The grading scale for this course is:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>97-100%</td>
<td>A +</td>
</tr>
<tr>
<td>93-97%</td>
<td>A</td>
</tr>
<tr>
<td>90-93%</td>
<td>A -</td>
</tr>
<tr>
<td>87-90%</td>
<td>B +</td>
</tr>
<tr>
<td>83-87%</td>
<td>B</td>
</tr>
<tr>
<td>80-83%</td>
<td>B -</td>
</tr>
<tr>
<td>77-80%</td>
<td>C +</td>
</tr>
<tr>
<td>73-77%</td>
<td>C</td>
</tr>
<tr>
<td>70-73%</td>
<td>C - *</td>
</tr>
<tr>
<td>60-70%</td>
<td>D *</td>
</tr>
<tr>
<td>0-60%</td>
<td>Failing *</td>
</tr>
</tbody>
</table>
* Grades of "C-" and "D" in this course are considered unsatisfactory. According to departmental policy, no C- or D in ECE, BENG, BIOL, CS or ENGR courses can be submitted for the degree in Bioengineering. You will need to repeat the course if you obtain a grade of C- or lower.

Class Attendance:

<table>
<thead>
<tr>
<th>100 points</th>
<th>80 points</th>
<th>60 points</th>
<th>40 points</th>
<th>20 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never misses classes</td>
<td>Rarely misses classes</td>
<td>Sometimes misses classes</td>
<td>Absent for most classes</td>
<td>Rarely attends classes</td>
</tr>
</tbody>
</table>

Attendance to practical laboratories is mandatory to all students. Failure to attend will result in failure in the course.

GMU Policies and Resources for Students:

- Students must adhere to the guidelines of the George Mason University Honor Code [See http://academicintegrity.gmu.edu/honorcode/].
- Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/all-policies/].
- Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students’ personal experience and academic performance [See http://caps.gmu.edu/].
- Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu/].
- Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See http://writingcenter.gmu.edu/].

Professional Dispositions:

- Students are expected to exhibit professional behaviors and dispositions at all times.

Core Values Commitment:

- The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research–based practice, and social justice. Students are expected to adhere to these principles. [See http://cehd.gmu.edu/values/].

WAVES: Wellness, Alcohol and Violence Education and Services:
WAVES promotes wellness within the Mason community through health education, alcohol/drug assessment and education, and violence awareness, prevention and sexual assault response. We help students make healthy, safe choices and encourage lifelong, thoughtful healthy decision-making through individualized support, creative programming, and evidence-based education and outreach.

WAVES office 703-993-9999
SUB I, Suite 3200
24-Hour Sexual and Intimate Partner Violence Crisis Line 703-380-1434
waves.gmu.edu

- 703-360-7273 (Fairfax County Office for Women and Domestic and Sexual Violence Services 25 hotline)
- 703-228-4848 (Arlington County Domestic Violence Services Hotline)
- 703-368-4141 (Prince William County Sexual Assault Victims Advocacy Services (SAVAS) hotline)
- 1-800-838-8238 (Virginia Family Violence and Sexual Assault Hotline)
- 1-800-656-HOPE (Rape, Abuse and Incest National Network)
- https://ohl.rainn.org/online/

CAPS: Counseling and Psychological Services:
Counseling and Psychological Services (CAPS) provides a wide range of free confidential services to students, faculty, and staff. Services are provided by a staff of professional clinical psychologists, social workers, counselors, learning specialists, and psychiatric providers. CAPS individual and group counseling, workshops, and outreach programs are designed to enhance students’ personal experience and academic performance. Visit us at caps.gmu.edu for additional resources.

- For consultation or emergency assistance during office hours call 703-993-2380.
- For assistance during non-office hours, call University Police at 703-993-4357.
- 703-527-4077 (CrisisLink)
- 1-800-273-8255 (National Suicide Prevention Lifeline)
- 1-877-838-2838 (Veterans' Crisis Hotline)

Student Health Services (SHS) — Provides confidential health care to enrolled students in emergency and non-emergency circumstances on the Fairfax, Arlington and Prince William campuses. If there is a medical emergency and Student Health Services (SHS) is closed, please contact the free after-hours nurse ((703) 993-2831), a hospital emergency room, an urgent care facility, or call 911.

SUB 1, Suite 2300
703-993-2831

University Police:
Emergency: 911
Non-Emergency: (703) 993-2810
Reporting a Crime (Crime Solvers Anonymous Tip Hot-Line): (703) 993-4111
Mason Police Website: http://police.gmu.edu/
Eric Heath, Chief of Police Phone: (703) 993-3840 E-mail: eheath2@gmu.edu
Tentative Course Outline:

- Week 1 (August 29th)
  - Course overview, policies and requirements
  - Lecture 1 – Introduction to Clinical Neuroscience
- Week 2 (Sep 5th)
  - Lecture 2 – Overview of shunt devices and cerebrospinal fluid
  - Lab Protocol 1
- Week 3 (Sep 12th)
  - Laboratory 1 – Cerebrospinal Fluid (CSF) and Ventriculoperitoneal Shunts (VPS)
- Week 4 (Sep 19th)
  - Lab Report 1
  - Lecture 3 – Apply engineering concepts to shunt related problems
- Week 5 (Sep 26th)
  - Lecture 4 – Overview of medical imaging techniques
  - Lab Protocol 2
- Week 6 (Oct 3rd)
  - Laboratory 2 – Neuroradiology and Neuroimaging
- Week 7 (Oct 10th)
  - No Class (Columbus Day)
- Week 8 (Oct 17th)
  - Lab Report 2
  - Lecture 5 – Apply engineering concepts to medical imaging problems
- Week 9 (Oct 24th)
  - Midterm Exam – Exercises on Laboratory 1 and 2
- Week 10 (Oct 31st)
  - Lecture 6 – Overview of neurophysiology and neuromodulation
  - Lab Protocol 3
- Week 11 (Nov 7th)
  - Lab Practical 3 - Neurophysiology and Neuromodulation
- Week 12 (Nov 14th)
  - Lab Report 3
  - Lecture 7 - Apply engineering concepts to neurophysiology and neuromodulation
- Week 13 (Nov 21st)
  - Lecture 8 – Overview of stereotaxy and neuro intervention systems
  - Lab Protocol 4
- Week 14 (Nov 28th)
  - Lab Practical 4 – Neurosurgical Stereotaxy
- Week 15 (Dec 5th)
  - Lab Report 4 - Apply engineering concepts to neuro intervention systems
- Week 16 (Dec 12th)
  - No class (Reading Day)
- Week 16 (Dec 19th)
  - Final Exam - Exercises on Laboratory 3 and 4